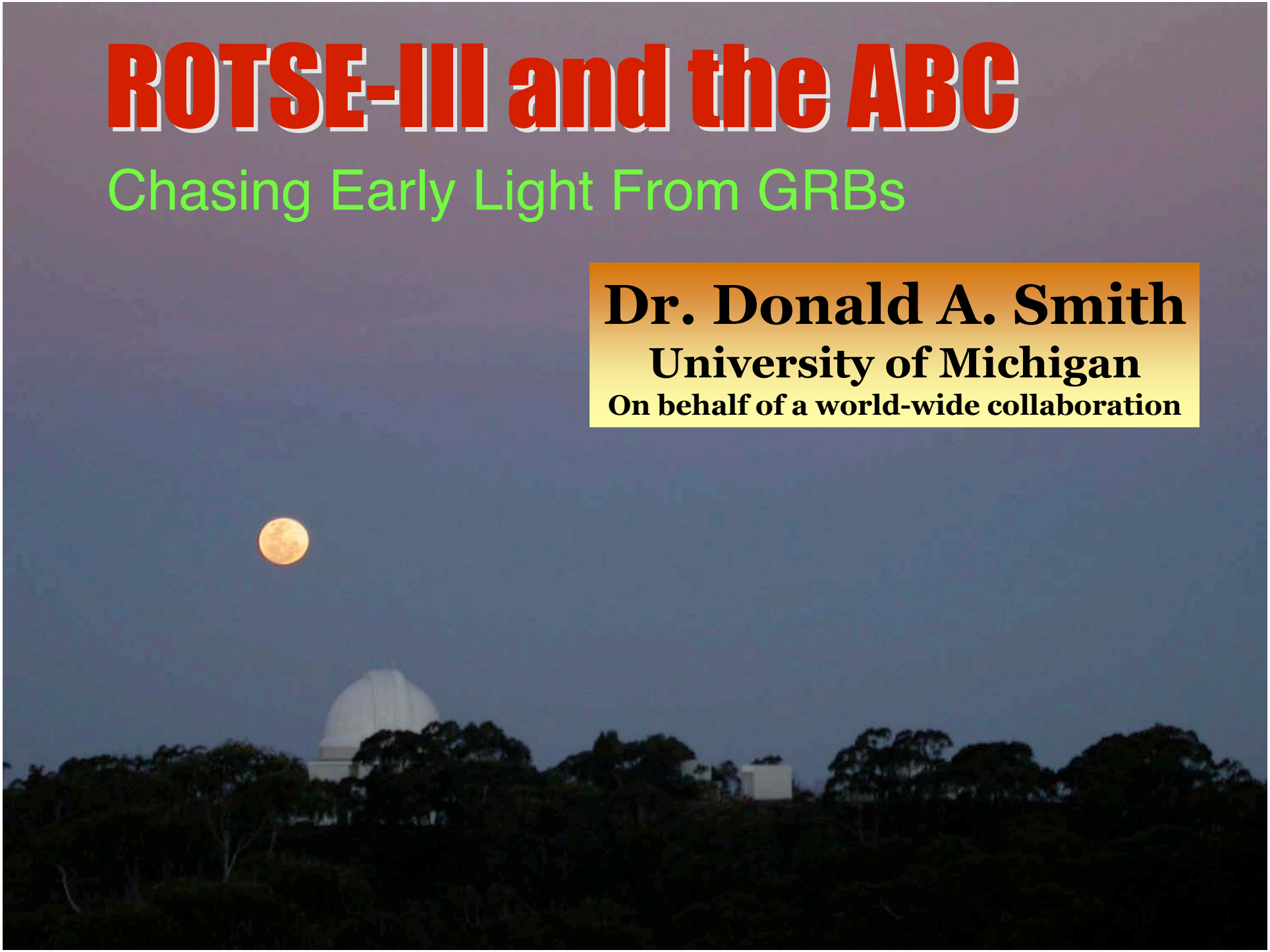
ROTSE-III and the ABC

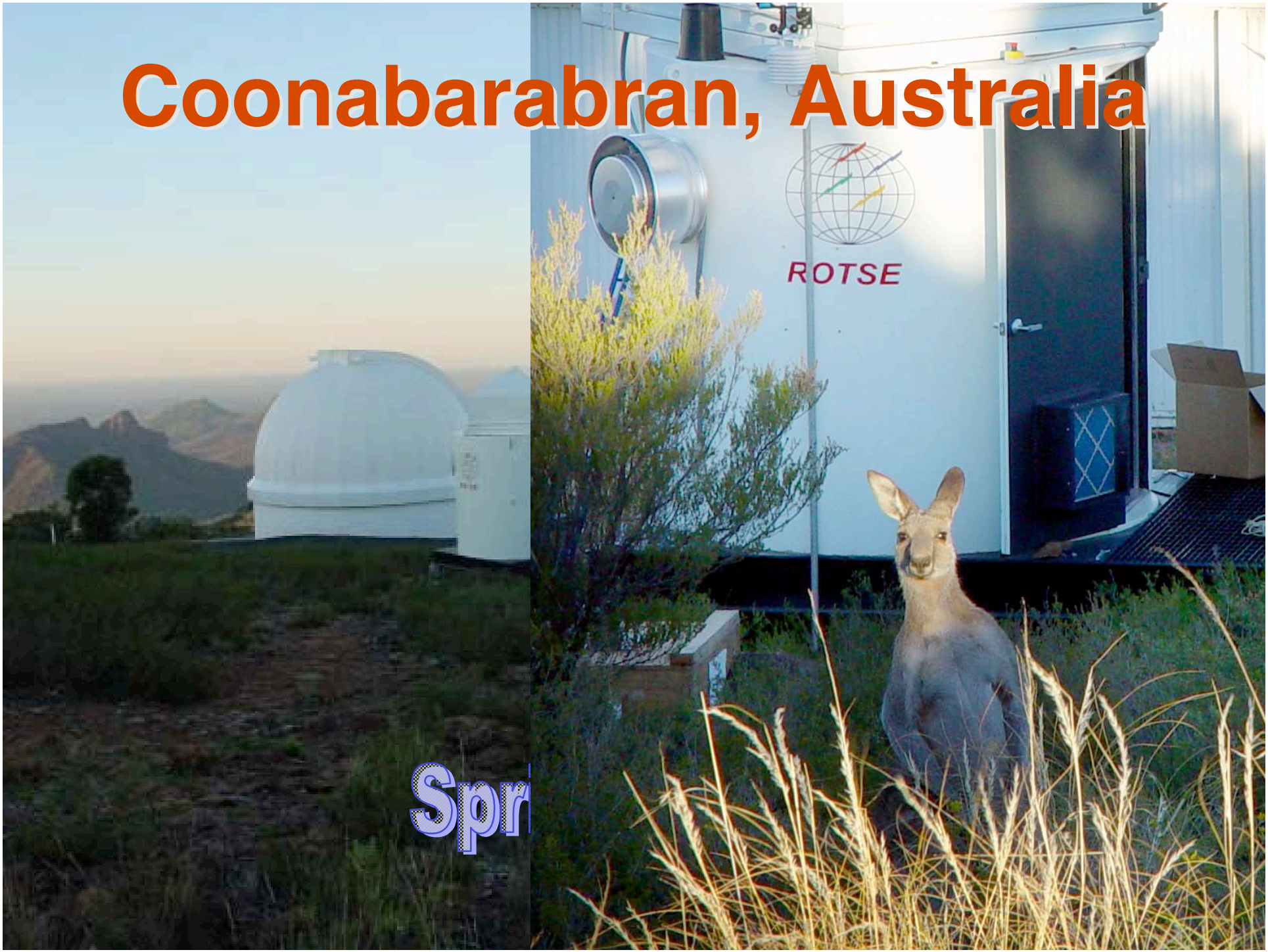
Chasing Early Light From GRBs

Dr. Donald A. Smith
University of Michigan
On behalf of a world-wide collaboration



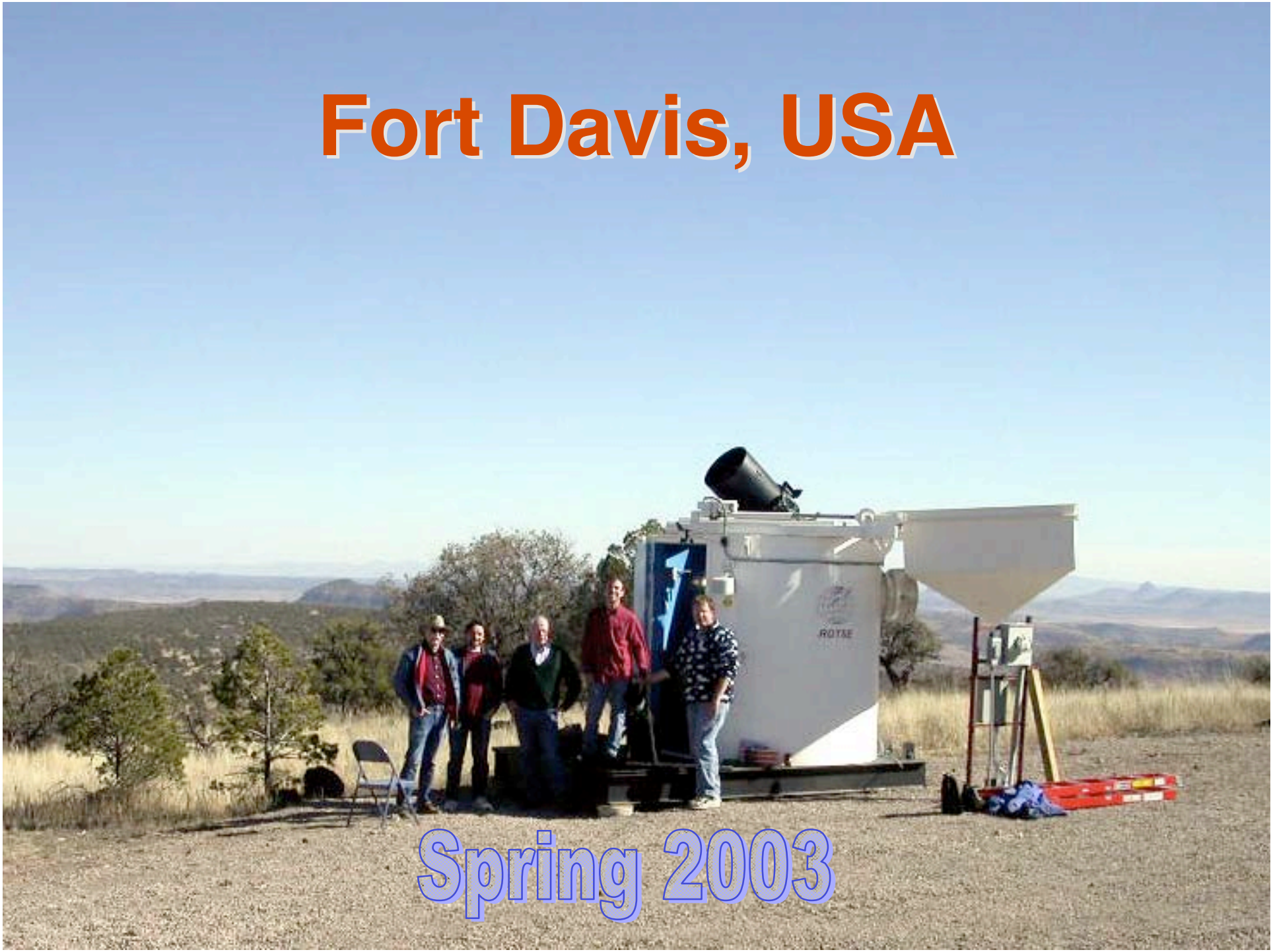
ROTSE-III Around the World

Coonabarabran, Australia



ROTSE-III Around the World

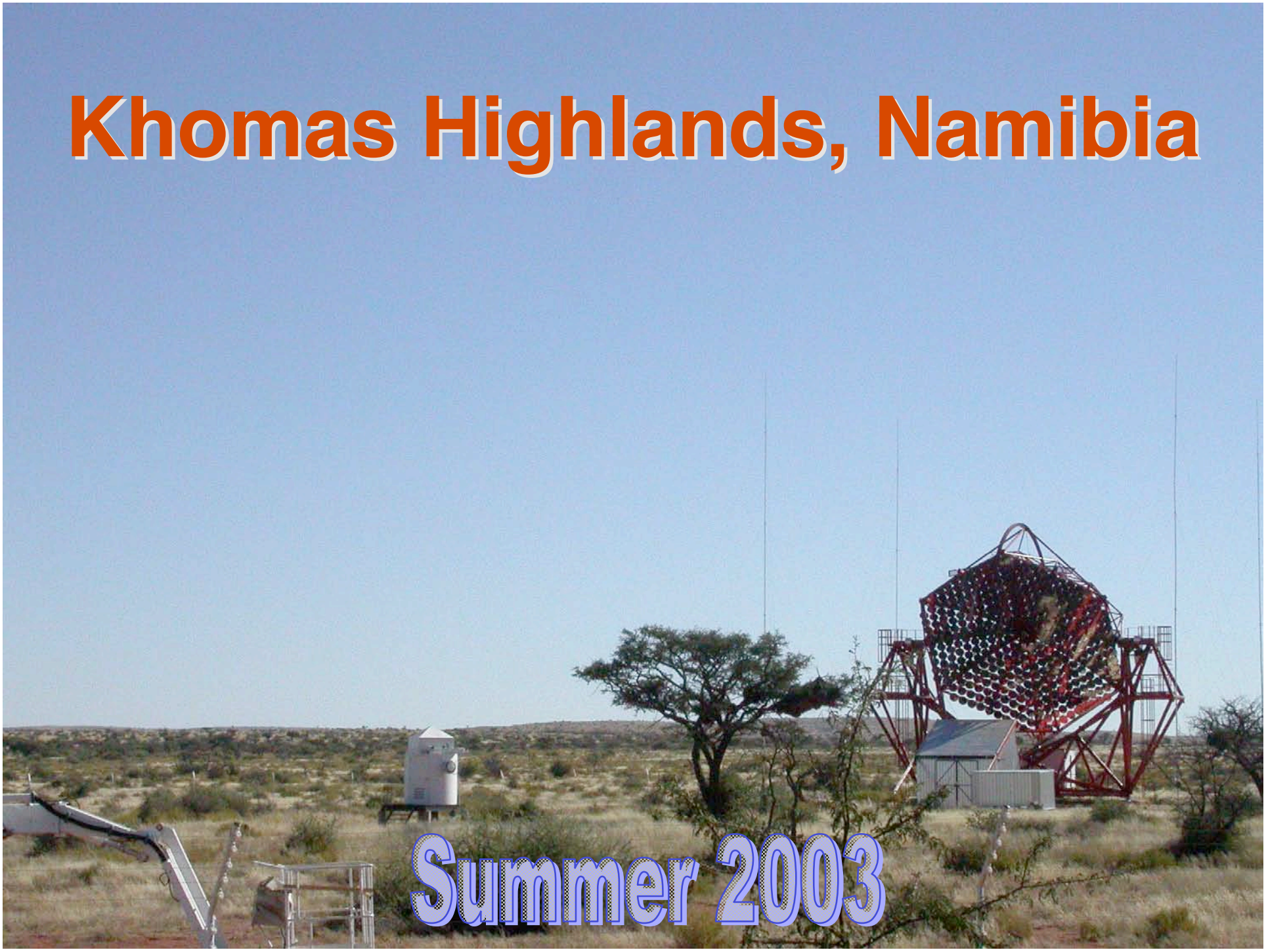
Fort Davis, USA



Spring 2003

und the World

Khomas Highlands, Namibia



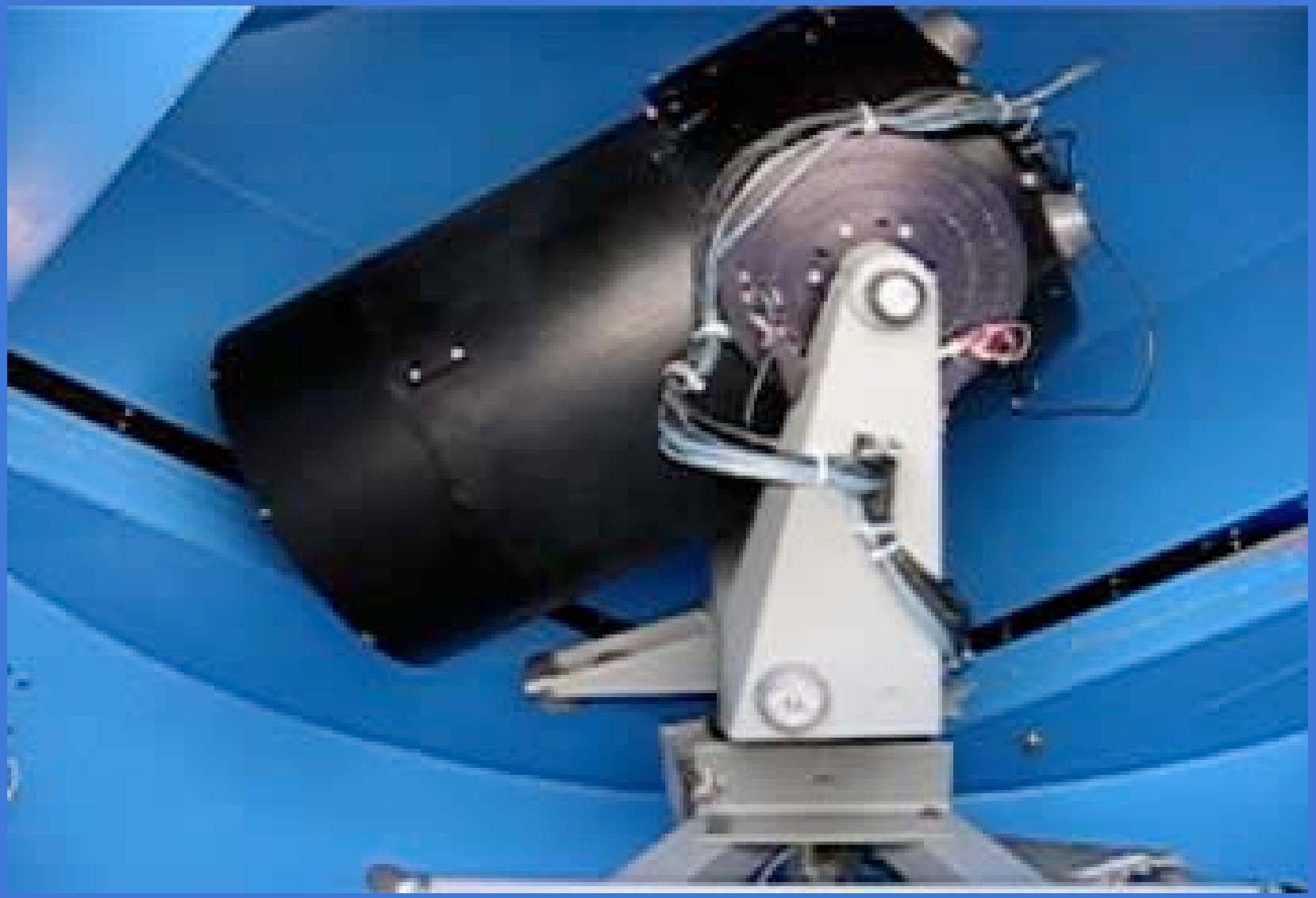
und the World

Bakirlitepe, Turkey


The Sun Never Rises
on the ROTSE Array
ROTSE


ROTSE-IIId
Comet C/2001 Q4 (NEAT)
All Systems Go!

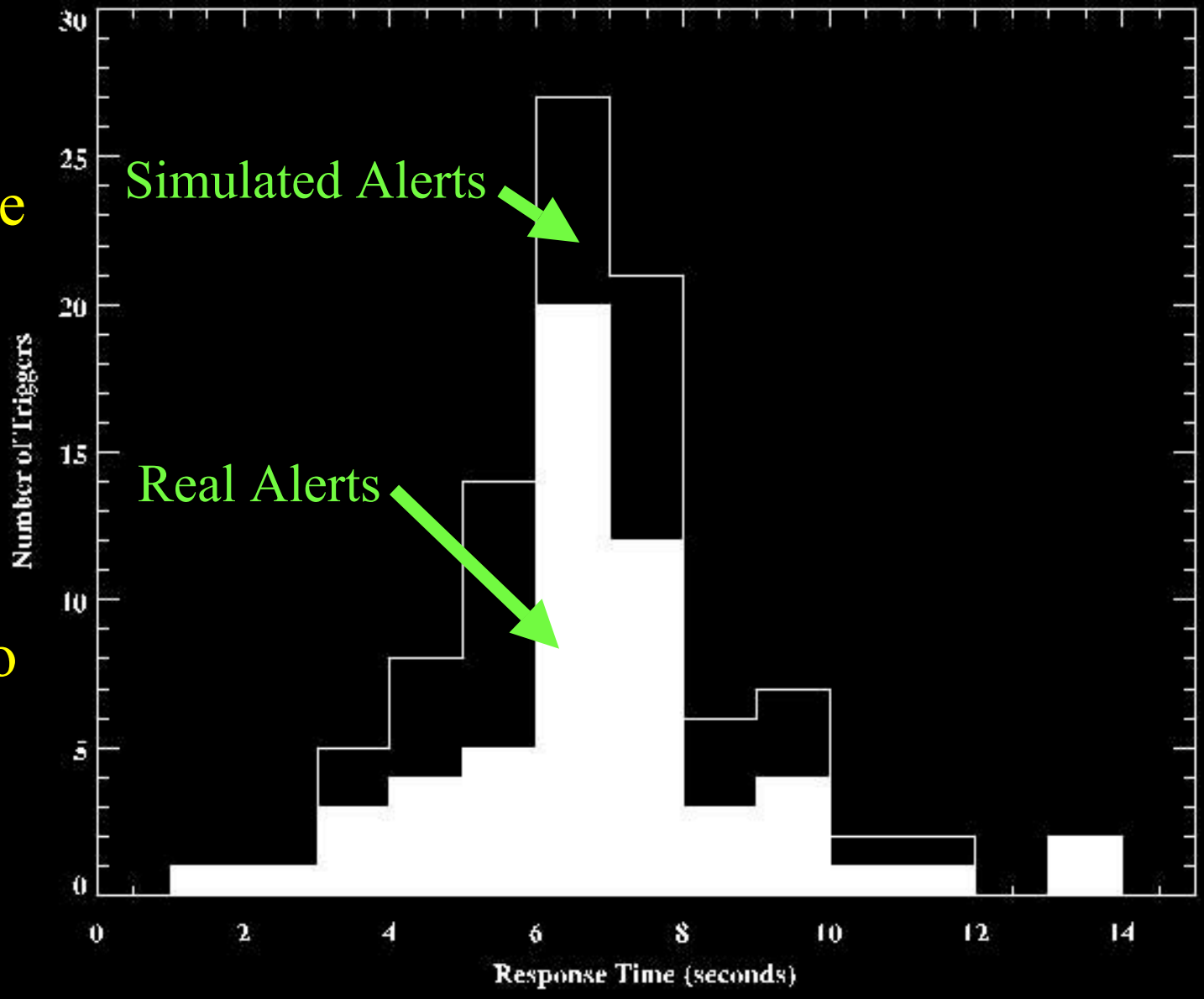
Built for Speed



Rapid GRB Response

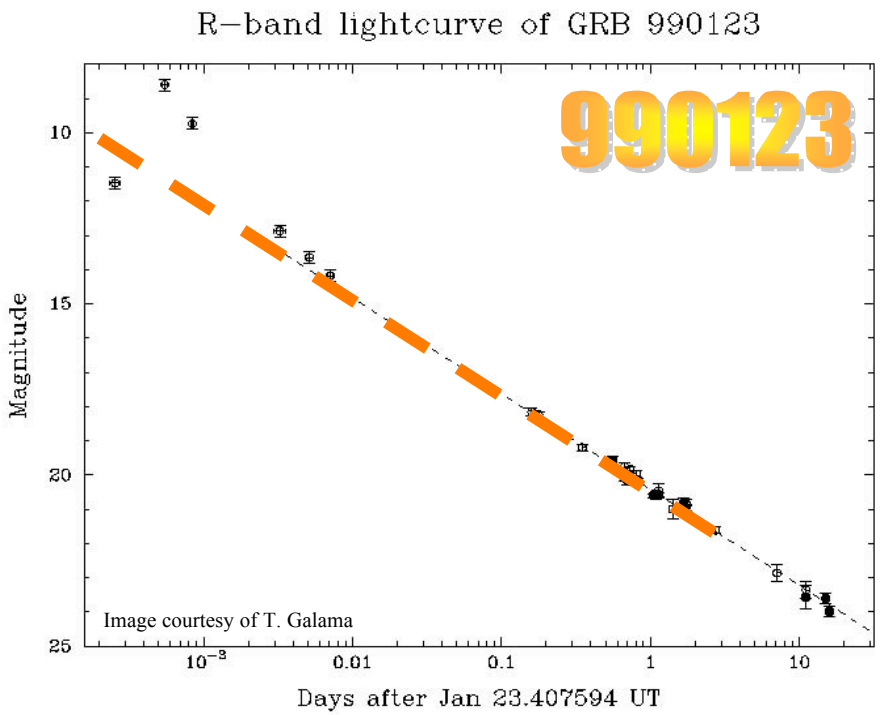
Median response time from alert is ~6-7s

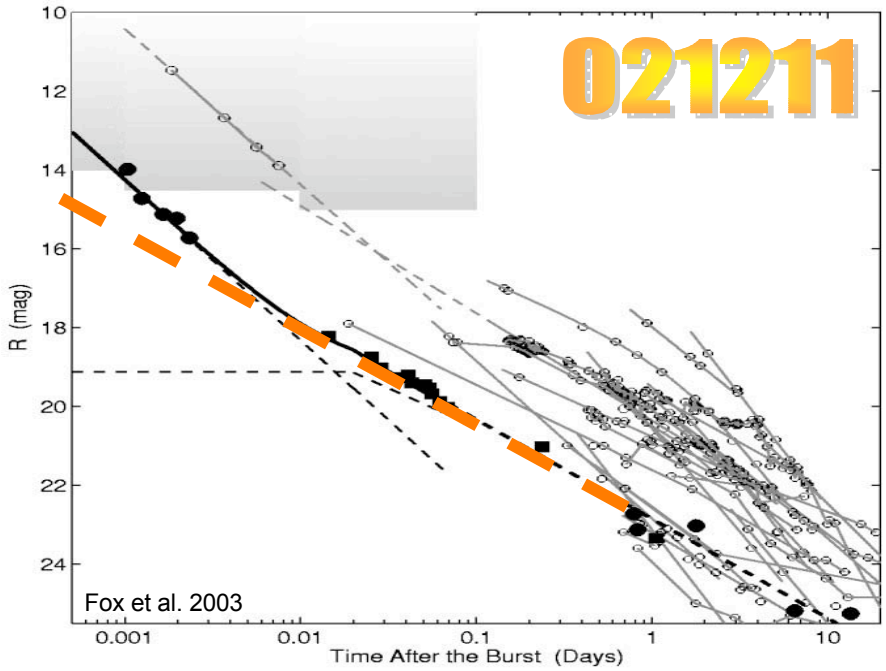
3c is ~1-2s slower due to internet link

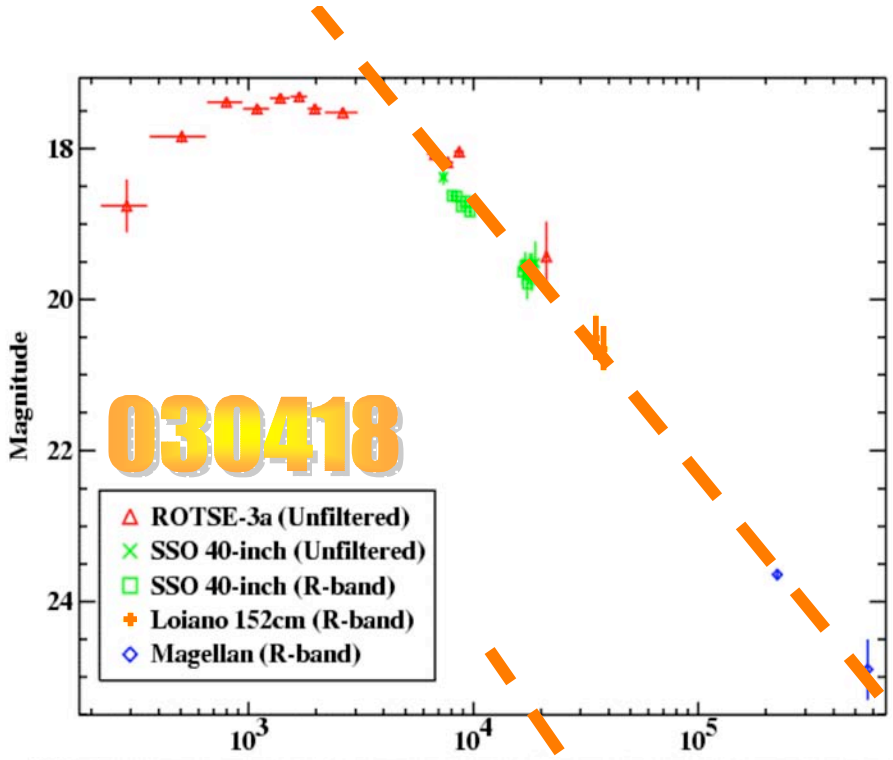


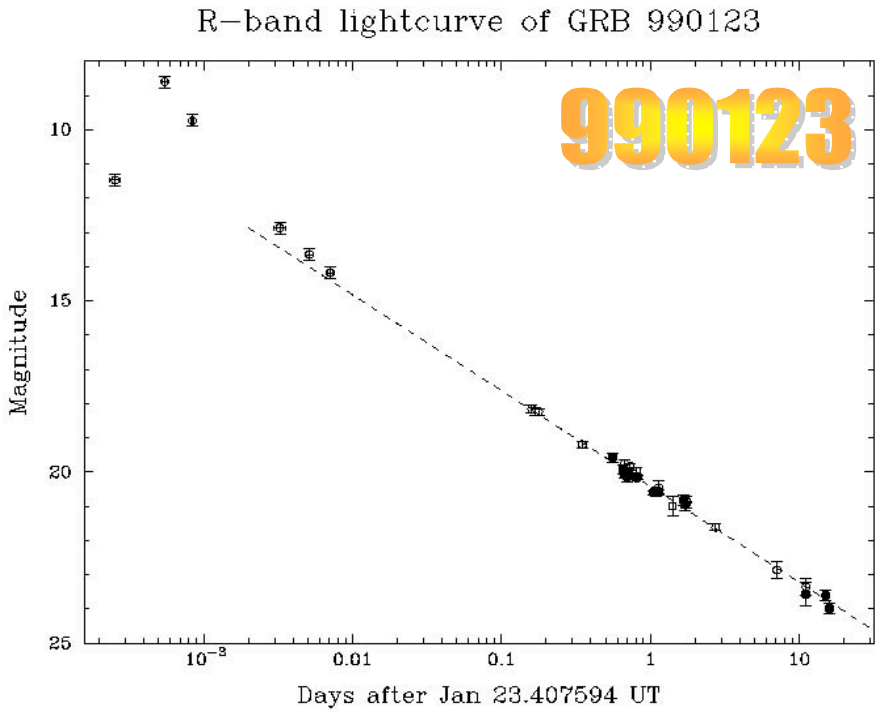
Some bursts' early optical light curves showed excess emission

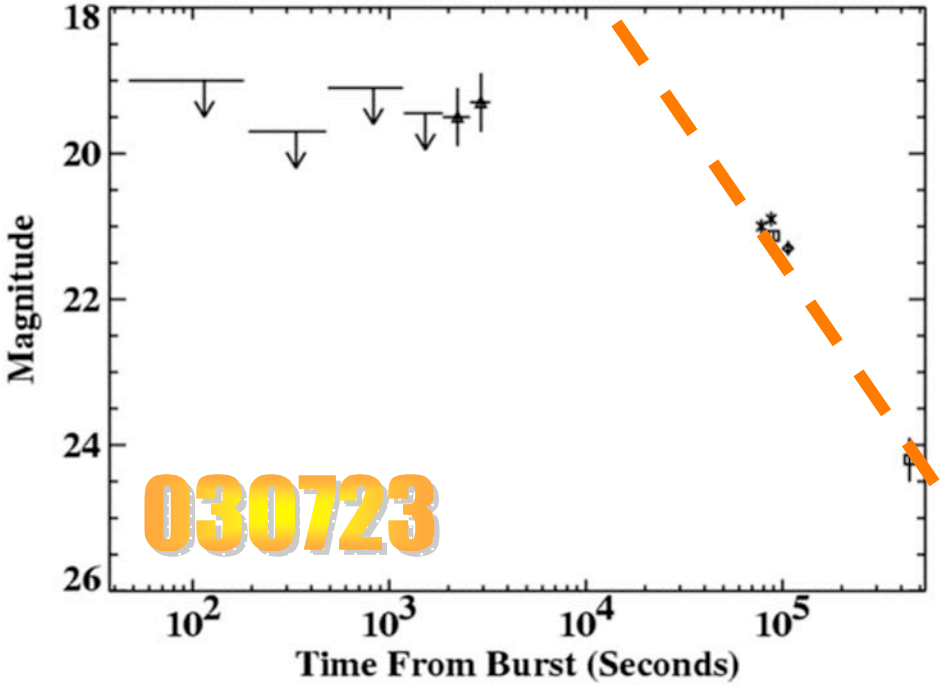
Attributed to reverse shock.

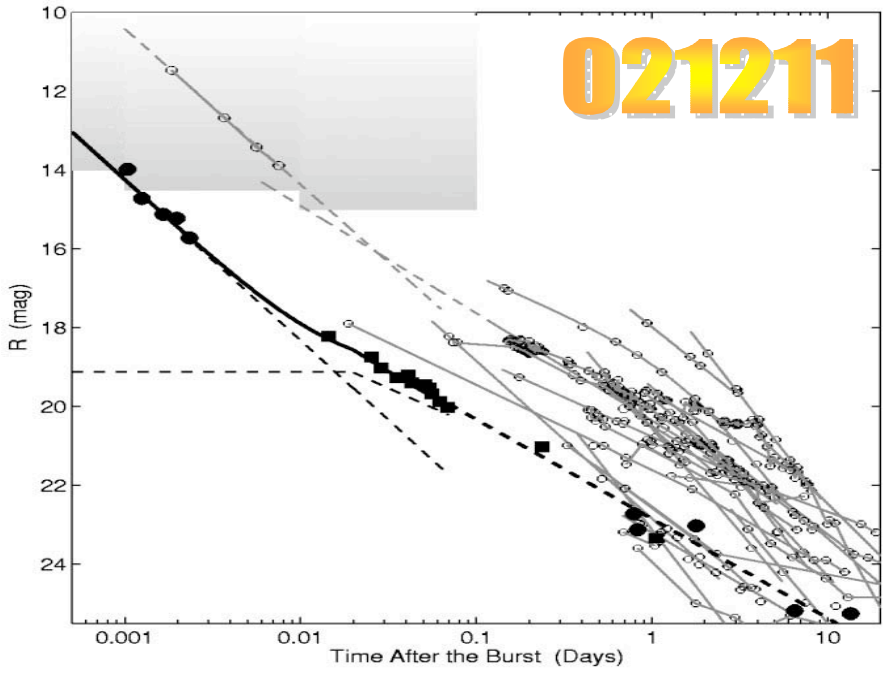




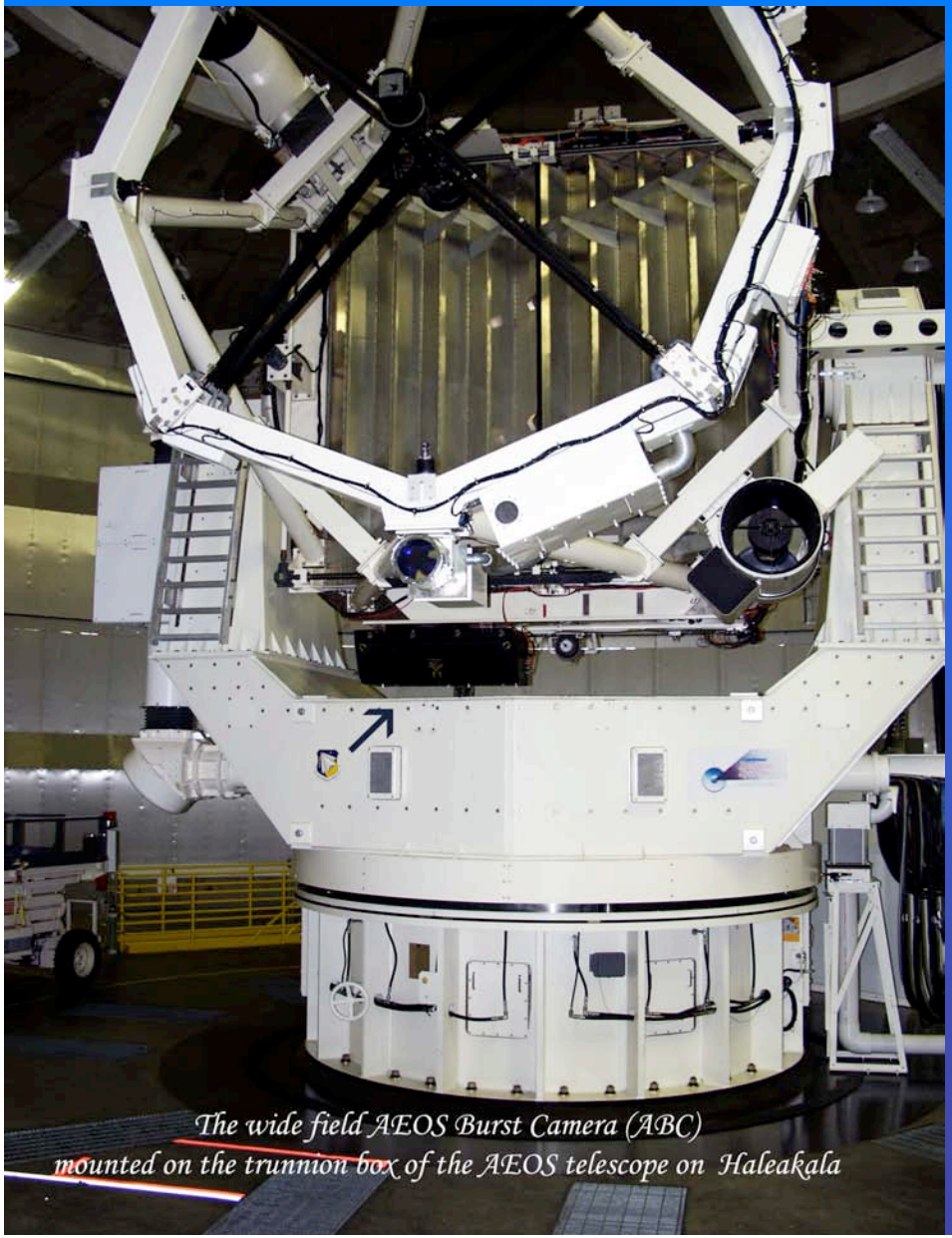

030418
Magnitude
ROTSE-3a (Unfiltered)
SSO 40-inch (Unfiltered)
SSO 40-inch (R-band)
Loiano 152cm (R-band)
Magellan (R-band)


R−band lightcurve of GRB 990123
990123
Magnitude
Days after Jan 23.407594 UT


030723
Magnitude
Time From Burst (Seconds)


021211
R (mag)
Time After the Burst (Days)

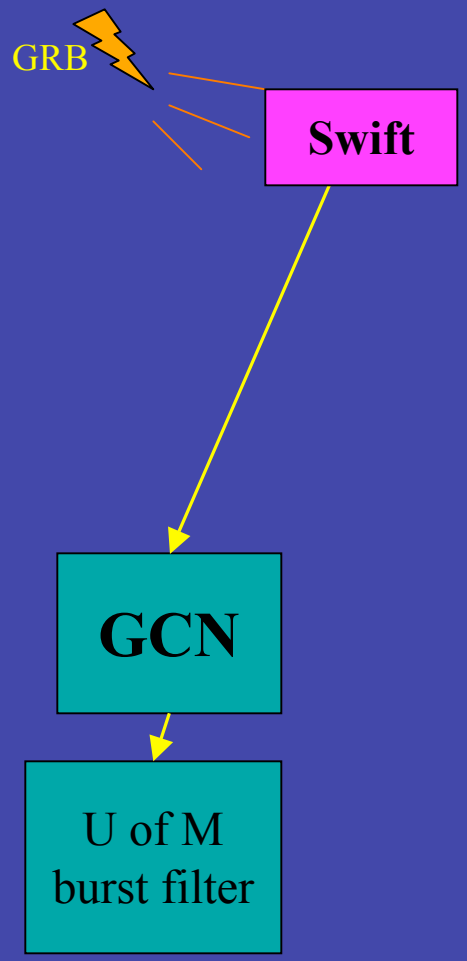
AEOS Burst Camera (ABC)



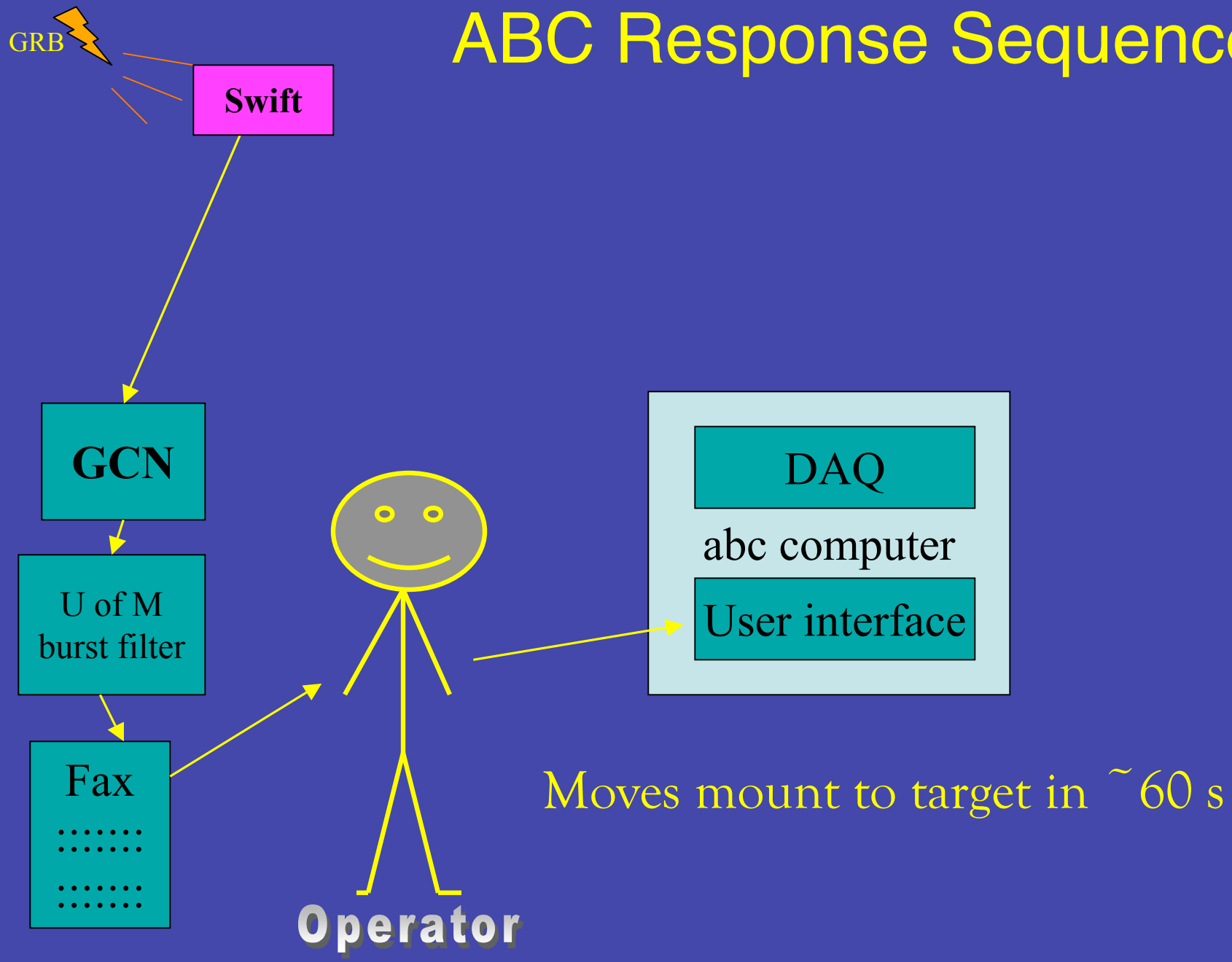
The wide field AEOS Burst Camera (ABC) mounted on the trunnion box of the AEOS telescope on Haleakala

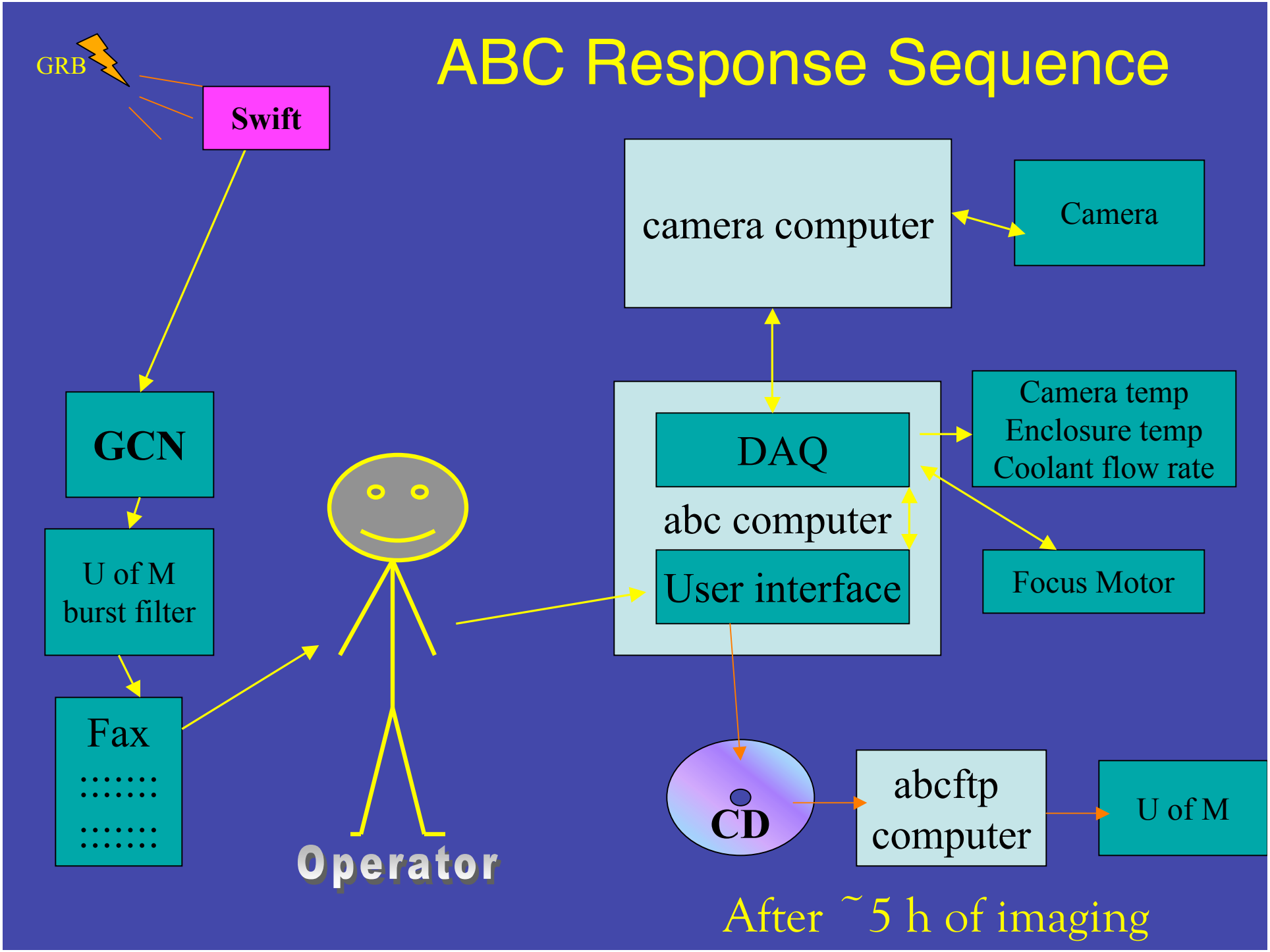
- Designed by Carl Akerlof
- Fabricated by Astronomical Research Cameras & Alan Schier's Pilot Group
- Marconi 2Kx2K CCD, cooled to –40 C
- Field of view ~ 6 arc min.
- Currently uses unfiltered light
- 10 second CCD exposures
- Limiting mag ~ 22.

ABC Response Sequence



ABC Response Sequence




ABC Response Sequence
GRB
Swift
GCN
U of M
burst filter
Fax
Operator
camera computer
Camera
DAQ
abc computer
User interface
Camera temp
Enclosure temp
Coolant flow rate
Focus Motor
CD
abcftp
computer
U of M
After ~5 h of imaging

GRB Observations With AEOS

Faxes have been sent twice

- Aug 13, 2003, camera computer was down, no observations
- Aug 24, 2003, AEOS telescope was down, no observations

Both alerts turned out to be false alarms

Images of GRBs taken manually

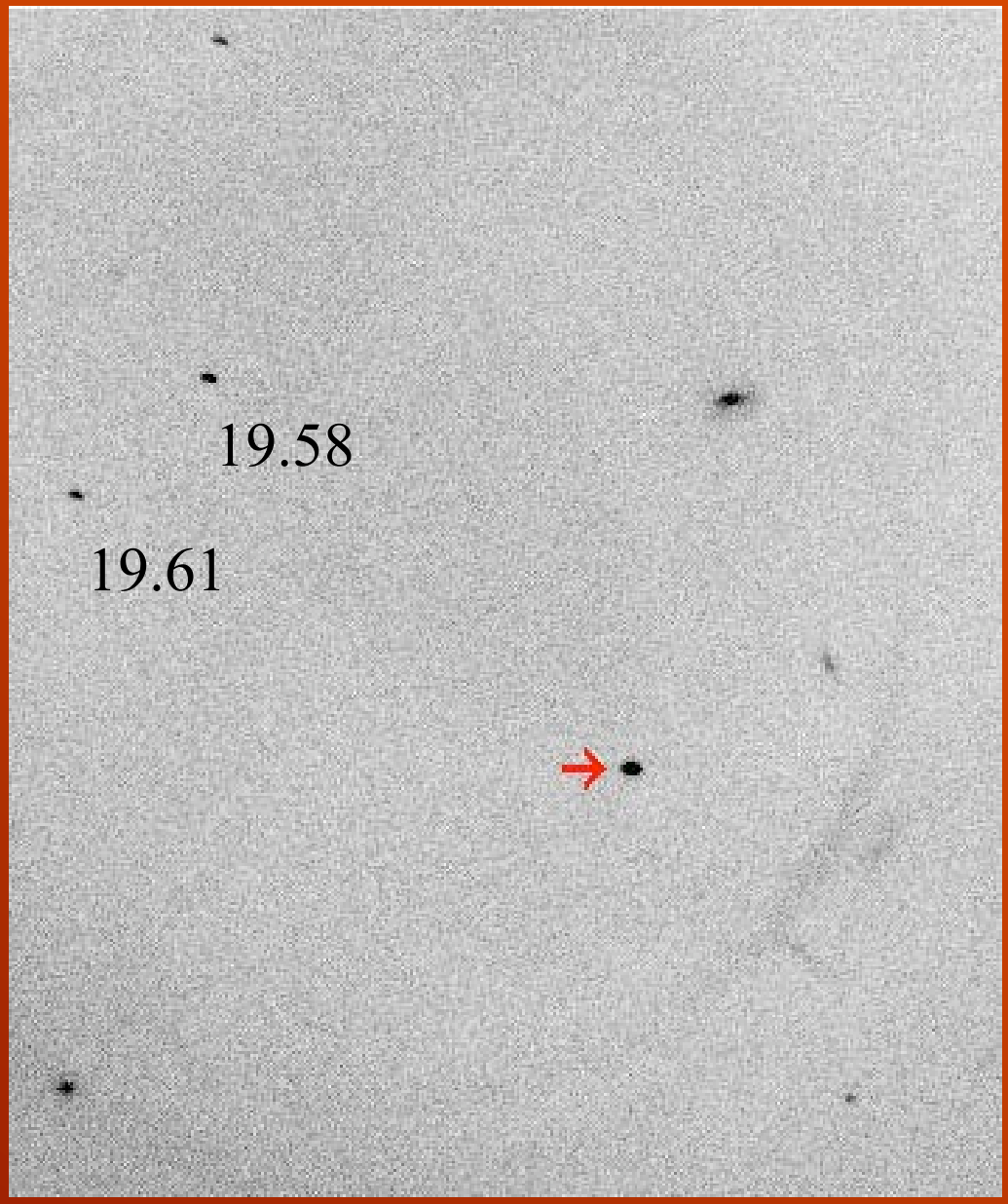
- GRB030418, ~29 images taken Apr 25, 2003, too dim
- GRB030329, 2 images taken Apr 1, 2003, GRB detected

No other GRB alerts have passed the filter yet

Expect 1 out of 15 Swift alerts to be observable

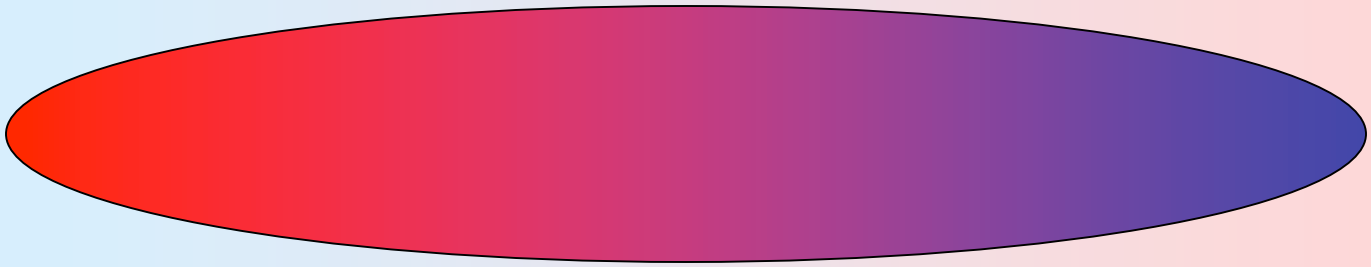
GRB 030329

- Imaged 2003 April 1, 10:42 GMT
- 10 sec exposure
- Red arrow is GRB, V~17.85

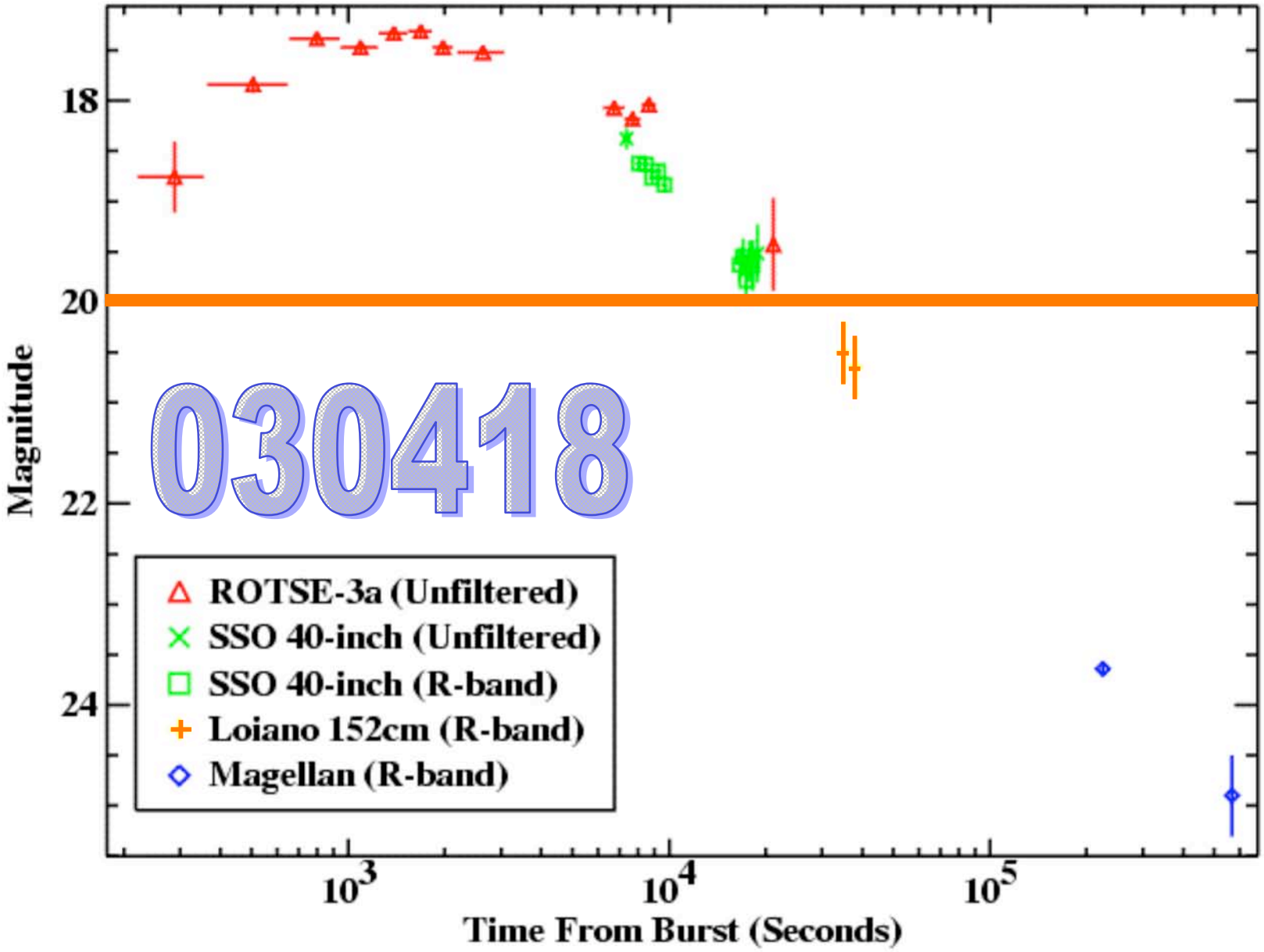


Blazed Transmission Grating

- Materials are being installed right now
- Allows low resolution spectral information
- Will allow unique study of early evolution
- Distinguish between cooling and absorption



Evolution vs. Absorption?



Conclusions

- ROTSE-III and ABC are ready for Swift
- Fast response and sensitivity are key
- Gratings will add modest spectral data
- Discoveries could include:
  - Fast-decaying bursts
  - Role of absorption
  - Details of reverse shock physics
  - Origin of short bursts

See also poster 18.15 on Thursday